

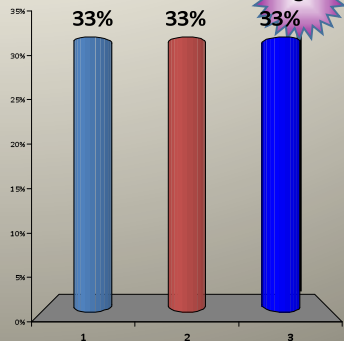
Welcome to Class 2: Science History, Pseudoscience and Theory

Did people in Columbus's time think the Earth was flat?

What is pseudoscience and how do you identify it?

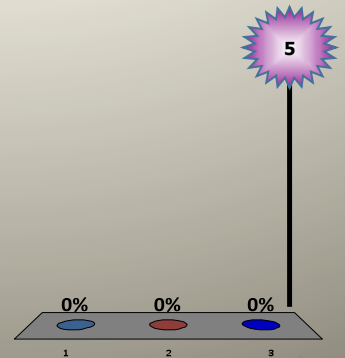
I registered my PRS transmitter on blackboard, brought it to class today, turned it on, and set it to channel 80 (CH, 80, CH)

1. Yes, I'm certain
2. Not sure
3. What's a PRS?



Which of today's Learning Objectives seem most difficult to master?

1. How Greek philosophy differed from earlier cultures & paved the way to modern science?
2. Provide 3 example methods differentiating between science and pseudoscience
3. Compare/Contrast a scientific theory with the popular usage of the term theory & give examples.

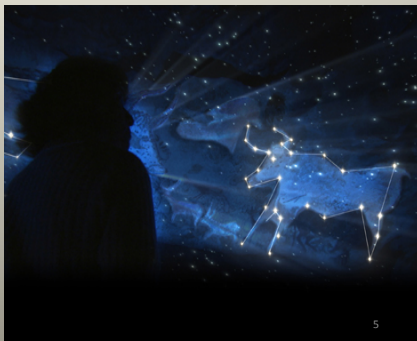


Let's get to work..

Everyone join a group with from 3 to 5 people.

Discuss then answer the following question as a group on paper:

Give THREE REASONS people of early cultures watch and record the motion of 'the heavens'?

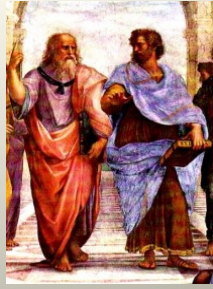


Importance of astronomy to early cultures

1. Why would seasons be important?
2. Why would tides be important?
3. How might time be kept through astronomy?
4. Why might astronomy be important for religion?
5. Did early people devise models for the universe?
6. Were early people helped by aliens?

"Extraordinary claims require extraordinary evidence"
Carl Sagan

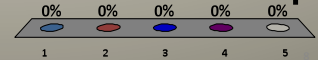
List methods used by the ancient Greeks which paved the way for modern science



- Individually, in your notes for two minutes, list three of their methods and philosophies.
- In your group take a few minutes to compare and discuss what you each wrote.

Which method of the early Greeks is not accepted by modern scientists?

1. Mathematics
2. Natural explanations
3. Philosophical thought
4. Debate/Challenge ideas
5. Observing facts



Why did the Greeks accept a (wrong) geocentric model for the universe?

Their observations lead them to think...

Parallax, clouds/birds, etc. : The earth wasn't moving.

The heavens should be harmonious, perfect, simple...

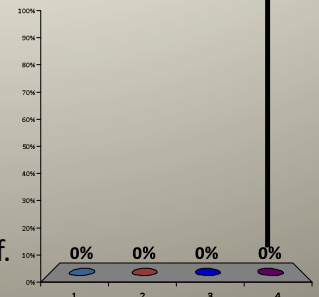
A priori expectations: the 'heavens' must move in perfect circles. Isn't this 'Occam's Razor'?

Did the Greeks know the Earth was a sphere (not flat)?

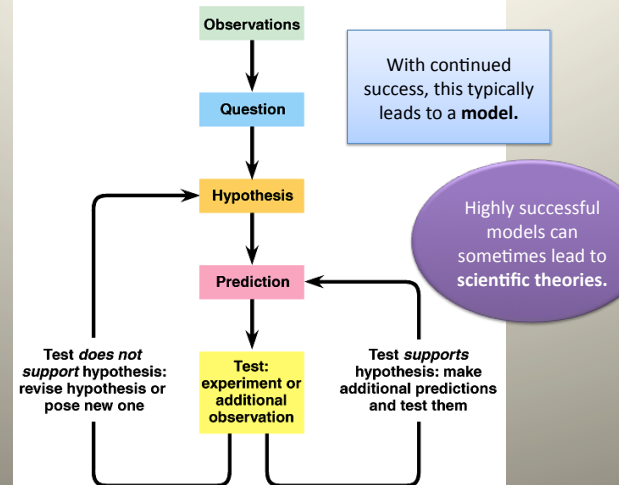
Yes. They even knew the diameter to a few percent. (They were the experts that invented geometry)

Do you believe scientific questions of our day affect your life?

1. No
2. Yes, but I don't have the answers anyway
3. Yes, but I rely on others as to what to believe.
4. Yes, and I try to understand them myself.



If this course helps you discover that some things you've believed for a long time are not true, how would you feel?



In your group, select an observation:

- Your car won't start
- Your mother doesn't return your phone call.
- Your jeans are too tight to zip up.
- Everyone is laughing at you as you enter a room.
- You woke up feeling sick.

Produce 3 HYPOTHESIS to explain your observation and construct a MATCHING PREDICTION to test each one.

A scientific Hypothesis

- An educated guess – using information already understood or constrained.
- NEEDS TO BE TESTABLE or make a PREDICTION
- Does not rely on 'the supernatural'

Hallmarks of Science

Explains observed phenomenon relying only on natural causes

Creation and testing of models to explain observations simply.

Models make testable predictions. Revise or abandon models if not in agreement with observations.

In your groups, fill in the blank boxes:

Science	Pseudo Science
	Uses unnatural, spiritual or mystical events to explain observed phenomenon.
Creates and tests models of nature to explain observations as simply as possible	
	Theories do not develop or change, models can not make predictions or are able to be tested.

Some characteristics of Pseudoscience

- Claims which can not be tested or verified
- Reliance on confirmation rather than refutation
- Lack of openness of testing by others
- A lack of progress in 'theory' development



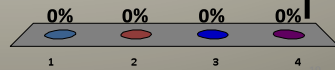
A Scientific Theory

- A model which survives repeated and varied testing.
- Has a powerful ability to predict and explain observations.
- Is relatively simple*, not contrived or needing modifications for different applications.
- **Un-provable (can not be proven true), but falsifiable (can be proven wrong).**

*Einstein's Theory of Relativity is by no means 'simple', but it is a single set of equations applied to all applications.

What is NOT true about a scientific theory?

1. Can be proved wrong
2. Can be proved right
3. Makes predictions
4. It is often a model to explain observed phenomenon



Examples of Scientific Theories

- Theory of Plate tectonics – describes the large scale **motion of Earth's lithosphere*** (~crust).
- Germ Theory of Disease – **Disease*** is often caused by microorganisms.
- Dalton's Atomic Theory of Matter – that **matter*** is made up of indivisible atoms.
- Darwin's Theory of Evolution – the **evolution*** of species is driven by natural selection.

*Observed phenomenon

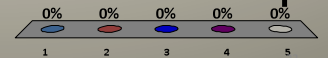
Spread out in the room.

Let's check your understanding of today's learning objectives.

Please work alone on this quiz

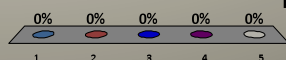
1. Prehistoric, ancient people were good astronomers but did NOT _____

1. Observe and predict eclipses
2. Predict seasons
3. Model the universe
4. Observe and predict tides
5. Use sun dials.



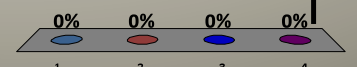
2. Which method of the early Greeks is not accepted by modern scientists?

1. Mathematics
2. Disregard explanations that did not work
3. Pure philosophical thought
4. Debate/Challenge
5. Observing facts



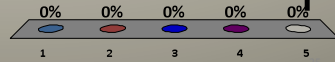
3. A good scientific hypothesis must be _____

1. Correct from the start.
2. Infallible (can't be proven wrong).
3. Randomly derived.
4. Testable.



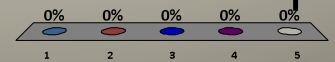
4. Which method below is a hallmark of *pseudoscience*?

1. Models can predict
2. Rigid, Unchanging theories
3. Strives for simplicity
4. Models open for outside testing
5. Explains without unnatural events.



5. A scientific theory

1. survives repeated testing
2. is able to make predictions.
3. is capable of being proved wrong.
4. can not be proved true.
5. All of the above.



To do list for next class

- Refer to the class syllabus
- Read assigned pages in textbook and review study questions and learning objectives.
- Take the on-line quiz through the class BB Site (before 6:30am the day of class).
- Register and bring PRS transmitter to class